REMARKS

A. Status of Claims

The Office Action dated May 8, 2009 has been reviewed, and the comments of the U.S. Patent Office have been considered. Claims 2-59 are currently pending. Claims 2, 3, 16 and 50 have been amended. New Claims 51-59 have been added. Claims 21 and 26-49 have been previously withdrawn. Claims 2-20, 22-25 and 50-59 are currently under consideration. Favorable reconsideration of this application is respectfully requested.

B. Amendments to Claims 2, 3, 16 and 50

Support for the amendments to Claims 2, 3 and 50 may be found in the specification at paragraphs [0009][1], [0012], [0013] and [0040] and in drawing FIGS. 2A, 2B, 3A and 3C, and in Claim 2 as originally filed, as well as elsewhere in the originally filed specification, drawings and claims.

Claim 16 has been amended to properly depend from Claim 2.

C. Support for New Claims 51-59

Support for new Claims 51 and 52 may be found in the specification at paragraphs [0007], [0012], [0024], [0026], [0027], [0028], [0038], [0078], [0107], [0108], [0109], [0110], [0111], [0112], [0114], [0117], [0171], [0172] and [0173], and in Claims 3, 4, 6, 22, 23, 24, 25, 30, 32, 47, 48 and 49, as originally filed, as well as elsewhere in the originally filed specification, drawings and claims.

Support for new Claims 52-57 may be found in originally flied Claim 30, as well as elsewhere in the originally specification, drawings and claims.

Support for new claims 58 and 59 may be found in the specification at paragraph [0065], and in originally filed claims 15 and 41, as well as elsewhere in the originally specification, drawings and claims.

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[1] All references to the specification are to U.S. Application No. 2008/024583 published October 9, 2008.

D. Examiner Interviews

Applicants wish to thank Examiners Patel and Ward for the courtesies extended to Applicants' representative during Examiner Interviews on July 21, 2009 and July 28, 2009 (Examiner Interviews). During the Examiner Interviews, it was agreed between Examiner Patel, Examiner Ward and Applicants' representative that Suga does not teach or suggest bonding objects at room temperature using a bonding portion to bond objects that are made of different materials than the bonding portion. During the Examiner Interviews, the Applicants' representative also pointed out that the rejections of Claims 2-20, 22-25 and 50 rely upon combining prior art that would not be combined by a person of ordinary skill in the art *i.e.* the rejections rely upon combining a reference relating to silicon-to-silicon binding with a reference for metal-to-metal binding. In addition, Applicants' representative pointed out that the claimed invention, in contrast to the cited references, does not require that the bonding portions be cleaned by heating.

E. Procedural Matters

Applicants note, with thanks, the Examiner's acknowledgement at Section 1 of the Office Action of the acceptance of the response filed April 6, 2009.[2]

F. Response to Rejection of Claims 2, 5, 13, 15, 17-19 and 22-25 under 35 U.S.C. § 103(a) as Being Unpatentable over Suga

At Section 2 of the Office Action, Claims 2, 5, 13, 15, 17-19 and 22-25 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Suga et al., in view of U.S. Patent Publication No. 2003/0164396 to Suga et al. (hereafter "**Suga**").[3] This rejection is respectfully traversed with respect to Claims 2, 5, 13, 15, 17-19 and 22-25 for the following reasons.

As currently presented, Claims 2, 5, 13, 15, 17-19 and 22-25 include the features of: "contacting said bonding portions of said objects to be bonded with each other in a **low vacuum of 10^{-5} Torr** or more in the atmospheric air; and **crushing an adhering substance layer readhering to said bonding portions by pressing said objects to be bonded, thereby bonding**

[2] See Office Action, p. 1.
[3] See Office Action, pp. 2-4.

objects to be bonded together, said adhering substance layer is formed of oxide film or organic substances, wherein said bonding portions of objects to be bonded are formed of **gold**, and bonding objects to be bonded is performed in a **solid phase** at a low temperatures between room temperature and 180°C."[4] In contrast, **Suga** specifically describes, "**thermally bonding** a **cleaned metal** joint part of the first object to a portion to be bonded of the second object by **heating** in special gas atmosphere."[5] Accordingly, **Suga** explicitly **teaches away from the claimed feature** of **bonding objects in solid phase by crushing an adhering substance layer readhering to gold bonding portions by pressing the objects to be bonded**. Therefore, **Suga** cannot teach or suggest all of the features of 2, 5, 13, 19 and 22-25 as required under 35 U.S.C. § 103.[6]

In rejecting Claims 2, 5, 13, 15, 17-19 and 22-25 over **Suga** the Office Action also relies upon the following allegations:

> *Allegation 1*: **Regarding claim 2**[7], Suga et al. ("**Suga**"[8]) discloses a bonding method [¶ 9; fig. 1] for bonding objects to be bonded which have a bonding portions (2a) formed of a metal, wherein the bonding portions include gold/tin or gold/gold bonding [¶ 10], and such gold-gold bonding portions inherently have a hardness of 200 Hv or less. Suga discloses that before bonding, the bonding portions are treated with an energy wave such as plasma or ion beam or atomic beam [¶ 11]. Suga does not expressly disclose bonding at room temperature after treating, however, **Suga does teach that energy wave irradiation of energy wave can be aimed to activate the surface up to a degree at which room-temperature bonding becomes possible [¶ 11].**[9]
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> *Allegation 2:* **Thus, one skilled in the art reading Suga would have understood and appreciated the possibility of room-temperature bonding due to energy wave treatment resulting in activated surfaces**.[10] In view of that, it would have been obvious to a person of ordinary skill in the art at the time of

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[4] Emphasis added. Claim 2 explicitly includes these features. Because Claims 5, 13, 15, 17-19 and 22-25 depend from Claim 2, either directly or indirectly, these claims also include these features.
[5] See **Suga**, paragraph [0009].
[6] 35 U.S.C. § 103 requires that "All words in a claim must be considered in judging the patentability of that claim against the prior art", see MPEP § 2143.03, citing *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).
[7] Emphasis in original.
[8] Emphasis in original.
[9] See Office Action, p. 2 (emphasis added).
[10] Emphasis added.

> the invention to carry out bonding at room temperature in the method of Suga because such avoids necessary heating for bonding and thus, saves associated energy and cost. Moreover, the claim would have been obvious because a person of ordinary skill has good reason to pursue the known options (focused energy wave treatment) within his or her technical grasp and if this leads to the anticipated success (room-temperature bonding), it is likely the product not of innovation but of ordinary skill and common sense.[11]

But Allegation 1 is a mischaracterization of what is taught and suggested by **Suga**. The "room temperature bonding method" described in [¶ 11] of **Suga**[12] is a **prior art bonding method for silicon-silicon bonding**, not the thermal bonding method of **Suga**.[13] Contrary to what is asserted in Allegation 1, in [¶ 11], **Suga** specifically teaches the **advantages over thermal bonding using a metal over room temperature bonding of silicon to silicon.**[14] Allegation 2 is erroneous and is unsupported by an evidence provided by the Office Action. Furthermore, because the Office Action has relied upon the mischaracterization of **Suga** of Allegation 1 and erroneous Allegation 2 in rejecting Claims 2, 5, 13, 15, 17-19 and 22-25 under 35 U.S.C. § 103(a) as being unpatentable over **Suga** is *prima facie* improper for at least this reason.

According to claim Claims 2, 5, 13, 15, 17-19 and 22-25, the adhering substance layer, such as oxide film or the like, atomically adhering to the bonding portion is completely removed with an energy wave, such all a plasma or the like. Then, the bonding is performed in a solid phase at low temperature between room temperature and 180°C in a low vacuum of 10^{-5} Torr or more in the atmospheric air which is assumed that impurities. such as dirt, dust. water molecules, organic substances or the like, are included.

That is, the bonding portions are contacted with each other under the environment in which the adhering substance layer adheres to the bonding portion. Even if the impurities, such as organic substances or the like, readhere to the bonding portion. the impurities are just absorbed onto the bonding portion. Therefore, the reabsorbed substance layer readhering to the bonding portion is pushed and moved by pressing the objects to be bonded by each other, and the objects to be bonded are bonded. In this case, an interface of the bonding portion is deformed during pressing the objects to be bonded by each other by making the bonding portion have a

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[11] See Office Action, pp. 2-3.
[12] **Suga**, paragraph [0011].
[13] See **Suga**, paragraphs [0005], [0007] and [0011].
[14] See **Suga**, paragraph [0011], as well as [0007], [0008] and [0009].

hardness of 200 Hv or less, so that the reabsorbed substance layer reabsorbed onto the bonding portion is pushed and moved to form a new surface on the bonding portion. As a result, the bonding portions are bonded in a solid phase (see, for example, Fig. 1 of the present application).

In **Suga's** process, because incomplete surface activation of the bonding portion is performed, there remains an adhering substance layer atomically bonding to the surface of the bonding portion. The adhering substance layer which atomically adheres cannot be crushed only by pressing, so that a new surface is not formed on the bonding portion, as in the claimed invention. Therefore, the heat diffusion bonding by heating the objects to be bonded is performed in **Suga**. Accordingly, based on **Suga**, there is no suggestion of the claimed invention wherein the readhering substance layer which readheres by being absorbed onto the surface of the bonding portion is crushed by pressing the objects to be bonded by each other.

In general **Suga** relates to a bonding method that employs heating, **melting** and diffusing a metal. Although the specification of **Suga** describes a gold/gold bonding, etc. as an example of the bonding between metal and metal, all of these bonding techniques require heating, **melting** and diffusing metal. **Therefore, the bonding technique of Suga. is clearly different from the bonding technique of the claimed invention which bonds using gold in a solid phase at low temperature between room temperature and 180°C** . According to **Suga**, since incomplete surface activation of the bonding portion is performed, an adhering substance layer remains atomically bonding to the surface of the bonding portion. But, in **Suga**, **the adhering substance layer which atomically adheres cannot not be crushed only by pressing, so that a new surface is not formed on the bonding portion**. Therefore, the **heat diffusion bonding of Suga requires heating the objects to be bonded so that the bonding portions melt and combine**. Therefore, based on **Suga**, cannot teach or suggest the claimed invention wherein a readhering substance layer which readheres by being absorbed onto the surface of the bonding portion is crushed by pressing the objects to be bonded by each other, thereby bonding the objects to be bonded together **in a solid phase**,

According to **Suga**, secondary oxidation of solder bumps during bonding the objects to be bonded by heating at high temperature is prevented in inert gas by blowing out a special gas free from impurities toward the solder bumps after oxide film (primarily oxidation) generated when forming the solder bumps is removed by Ar bombardment. Regarding the readhering substance layer which readheres by being absorbed onto the surface of the bonding portion after

complete surface activation thereof, it is highly probable to atomically bond to the bonding portion due to secondary oxidation by heating in the atmosphere if not blowing out the special gas as disclosed in **Suga**. Therefore, the objects to be bonded are contacted with each other at low temperature between room temperature and 180°C, in the present invention. According to the present invention, after completely removing the impurities from the bonding surface by Ar bombardment, the bonding surface contacts with the impurities again in a low vacuum of 10^{-5} Torr or more in the atmospheric air. If heated at high temperature in this condition, the bonding surface and the impurities are strongly atomically bonded. However, according to the present invention, because of **a low temperature between room temperature and 180°C**, the impurities are just absorbed onto the bonding surface, not strongly atomically bonded by heat diffusion bonding by heating the object to be bonded to melt and combine. Accordingly, since the impurities are easily moved by application of pressure or the like, the impurities are removed from the bonding surface. As a result, the bonding surfaces are bonded. The bonding technique taught or suggested by **Suga** is quite different from the present invention. Accordingly, it is not possible to come up with the present invention no matter how the invention described in **Suga** is combined with the technique suggested by **Suga**,

For at least the above reasons, Claims 2, 5, 13, 15, 17-19 and 22-25 are patentable over **Suga**.

G. Response to Rejection of Claims 3, 4 and 14 under 35 U.S.C. § 103(a) as Being Unpatentable over Suga in View of Gilleo

At Section 3 of the Office Action, Claims 3, 4 and 14 are rejected under 35 U.S.C. § 103(a) as being unpatentable over **Suga**, in view of U.S. Patent Application No. 2003/0164396 to Gilleo *et al.* (hereafter "**Gilleo**").[15] This rejection is respectfully traversed with respect to Claims 3, 4 and 14 as currently presented.

As currently presented, Claims 3 and 4 include the features of: "contacting said bonding portions of said objects to be bonded with each other in a **low vacuum of 10^{-5} Torr** or more in the atmospheric air; and **crushing an adhering substance layer readhering to said bonding portions by pressing said objects to be bonded, thereby bonding objects to be bonded**

[15] See Office Action, pp. 4-6.

together, said adhering substance layer is formed of oxide film or organic substances, wherein said bonding portions of objects to be bonded are formed of **gold**, and bonding objects to be bonded is performed in a **solid phase** at a low temperatures between room temperature and 180°C."[16] In contrast, **Suga** specifically describes, "**thermally bonding** a **cleaned metal** joint part of the first object to a portion to be bonded of the second object by **heating** in special gas atmosphere."[17] Accordingly, **Suga** explicitly **teaches away from the claimed feature** of **bonding objects in solid phase by crushing an adhering substance layer readhering to gold bonding portions by pressing the objects to be bonded**. Therefore, **Suga** cannot teach or suggest all of the features of 3 and 4 as required under 35 U.S.C. § 103.[18]

According to claims 3 and 4, the adhering substance layer, such as oxide film or the like, atomically adhering to the bonding portion is completely removed with an energy wave, such all a plasma or the like. Then, the bonding is performed in a solid phase at low temperature between room temperature and 180°C in a low vacuum of 10^{-5} Torr or more in the atmospheric air which is assumed that impurities. such as dirt, dust. water molecules, organic substances or the like, are included.

That is, the bonding portions are contacted with each other under the environment in which the adhering substance layer adheres to the bonding portion. Even if the impurities, such as organic substances or the like, readhere to the bonding portion. the impurities are just absorbed onto the bonding portion. Therefore, the reabsorbed substance layer readhering to the bonding portion is pushed and moved by pressing the objects to be bonded by each other, and the objects to be bonded are bonded. In this case, an interface of the bonding portion is deformed during pressing the objects to be bonded by each other by making the bonding portion have a hardness of 200 Hv or less, so that the reabsorbed substance layer reabsorbed onto the bonding portion is pushed and moved to form a new surface on the bonding portion. As a result, the bonding portions are bonded in a solid phase (see, for example, Fig. 1 of the present application).

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[16] Emphasis added. Claim 3 explicitly includes these features. Because Claim 4 depend from Claim 3, this claim also include these features.
[17] See **Suga**, paragraph [0009].
[18] 35 U.S.C. § 103 requires that "All words in a claim must be considered in judging the patentability of that claim against the prior art", see MPEP § 2143.03, citing *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

The specification of Suga discloses that **sufficient surface activation is not performed**, for example, a process by an atmospheric' pressure plasma, and that it is acceptable to perform the surface activation **to the extent possible to prevent primary oxidation**. As just described, if the impurities which are strongly atomically bonded to the atoms of the bonding surface are not completely removed, **heating at high temperature is necessary for bonding**. That is, Suga relates to conventional heat diffusion bonding to diffuse the impurities to bond (heating and melting the bump of the chip to bond). Although Suga describes gold/gold bonding as an example of the bonding between metal and metal, that is also the bonding technique, heat diffusion bonding.

In **Suga's** process, because incomplete surface activation of the bonding portion is performed, there remain adhering substance layer atomically bonding to the surface of the bonding portion. The adhering substance layer which atomically adheres cannot be crushed only by pressing, so that a new surface is not formed on the bonding portion, as in the claimed invention. Therefore, the heat diffusion bonding by heating the objects to be bonded is performed in **Suga**. Accordingly, based on **Suga**, there is no suggestion of the claimed invention wherein the readhering substance layer which readheres by being absorbed onto the surface of the bonding portion is crushed by pressing the objects to be bonded by each other.

In general **Suga** relates to a bonding method that employs heating, **melting** and diffusing a metal. Although the specification of **Suga** describes a gold/gold bonding, etc. as an example of the bonding between metal and metal, all of these bonding techniques require heating, **melting** and diffusing metal. Therefore, the bonding technique of **Suga**. is clearly different from the bonding technique of the claimed invention which bonds using gold in a **solid phase** at low temperature between room temperature and 180°C. According to **Suga**, since incomplete surface activation of the bonding portion is performed, an adhering substance layer remains atomically bonding to the surface of the bonding portion. But, in **Suga**, the adhering layer which atomically adheres cannot not be crushed only by pressing, so that a new surface is not formed on the bonding portion. Therefore, the heat diffusion bonding of **Suga** requires heating the objects to be bonded so that are melted to thereby allowing the combining of the bonding portions. Therefore, based on **Suga**, cannot teach or suggest the claimed invention wherein a readhering substance layer which readheres by being absorbed onto the surface of the bonding

portion is crushed by pressing the objects to be bonded by each other, thereby bonding the objects to be bonded together in a solid phase,

According to **Suga**, secondary oxidation of solder bumps during bonding the objects to be bonded by heating at high temperature is prevented in inert gas by blowing out a special gas free from impurities toward the solder bumps after oxide film (primarily oxidation) generated when forming the solder bumps is removed by Ar bombardment. Regarding the readhering substance layer which readheres by being absorbed onto the surface of the bonding portion after complete surface activation thereof, it is highly probable to atomically bond to the bonding portion due to secondary oxidation by heating in the atmosphere if not blowing out the special gas as disclosed in **Suga**. Therefore, the objects to be bonded are contacted with each other at low temperature between room temperature and 180°C, in the present invention. According to the present invention, after completely removing the impurities from the bonding surface by Ar bombardment, the bonding surface contacts with the impurities again in a low vacuum of 10^{-5} Torr or more in the atmospheric air. If heated at high temperature in this condition, the bonding surface and the impurities are strongly atomically bonded. However, according to the present invention, because of low temperature between room temperature and 180°C, the impurities are just absorbed onto the bonding surface, not strongly atomically bonded by heat diffusion bonding by heating the object to be bonded to melt and combine. Accordingly, since the impurities are easily moved by application of pressure or the like, the impurities are removed from the bonding surface. As a result, the bonding surfaces are bonded. The bonding technique taught or suggested by **Suga** is quite different from the present invention. Accordingly, it is not possible to come up with the present invention no matter how the invention described in **Suga** is combined with the technique suggested by **Suga**,

In addition, the rejection of Claims 3 and 4 over **Suga** relies upon erroneous Allegations 1 and 2.

For at least the above reasons, Claims 3 and 4 are patentable over **Suga**.

Claim 14 depends from Claim 2. Claim 2 is patentable over **Suga** for the reasons discussed above in Section F. **Gilleo** is only cited for allegedly describing: (1) forming a gold film on a surface of base materials having a hardness of 200 Hv or less, and after bonding that

the gold film is diffused into the base material,[19] (2) diffusing a gold film into a copper base,[20] and (3) the bonding portion is treated with an energy wave and that a metal electrode is provided at a position facing the bonding surface of at least one of the objects to be bonded, forming a metal film.[21] Accordingly, **Gilleo** cannot remedy the failure of **Suga** to teach or suggest the claimed feature of **bonding objects in solid phase by crushing an adhering substance layer readhering to gold bonding portions by pressing the objects to be bonded**. Therefore, the combination of **Suga** in view of **Gilleo** cannot teach or suggest all of these claimed features, and Claim 2 is patentable over **Suga** in view of **Gilleo** for at least this reason.

Because Claim 14 depends from Claim 2, this claim includes all of the patentable features of Claim 2. Therefore, Claim 14 is patentable over the combination of **Suga** in view of **Gilleo** for at least the same reasons that Claim 2 is patentable over this combination.

[19] See Office Action, pp. 4-5.
[20] See Office Action, p. 5.
[21] See Office Action, pp. 5-6.

H. Response to Rejection of Claims 6, 8 and 23 under 35 U.S.C. § 103(a) as Being Unpatentable over Suga in View of Yamauchi.

At Section 4 of the Office Action, Claims 6, 8 and 23 are rejected under 35 U.S.C. § 103(a) as being unpatentable over **Suga** in view of U.S. Patent Application No. 2004/0169020 to **Yamauchi**, (hereafter "**Yamauchi**").[22] This rejection is respectfully traversed with respect to Claims 6, 8 and 23 as currently presented.

Claims 6, 8 and 23 depend from Claim 2, either directly or indirectly. Claim 2 is patentable over **Suga** for the reasons discussed above in Section F. **Yamauchi** is only cited for allegedly describing: (1) generating a plasma and **cleaning using an electric field**,[23] (2) a wave generating power supply capable of controlling pulse width,[24] and (3) treating a wafer again with an energy wave after a predetermined time has passed.[25] Accordingly, **Yamauchi** cannot remedy the failure of **Suga** to teach or suggest the claimed feature of **bonding objects in solid phase by crushing an adhering substance layer readhering to gold bonding portions by pressing the objects to be bonded**. Therefore, the combination of **Suga** in view of **Yamauchi** cannot teach or suggest all of these claimed features, and Claim 2 is patentable over **Suga** in view of **Yamauchi** for at least this reason.

Because Claims 6, 8 and 23 depend from Claim 2, either directly or indirectly, these claims include all of the patentable features of Claim 2. Therefore, Claims 6, 8 and 23 are patentable over the combination of **Suga** in view of **Yamauchi** for at least the same reasons that Claim 2 is patentable over this combination.

In addition, with respect to Claim 8, this claim has been rejected based on the following allegation:

> ***Allegation 3*: As to claim 8**,[26] in accordance with broadest reasonable interpretation, the oscillating power supply of Yamauchi in the method of Suga (as explained in claim 6

[22] See Office Action, pp. 6-7.
[23] See Office Action, p. 6 (emphasis added).
[24] See Office Action, p. 6.
[25] See Office Action, pp. 6-7.
[26] Emphasis in original.

above) is equivalent to a wave generating power supply capable of controlling a pulse width.[27]

But, Allegation 3 is erroneous and unsupported by any evidence provided by the Office Action. Therefore, the combination of **Suga** in view of **Yamauchi** cannot teach or suggest all of the claimed features of Claim 8 for this additional reason, and Claim 8 is patentable over this combination for this additional reason.

In addition, with respect to Claim 23, this claim has been rejected based on the following allegation:

> ***Allegation 4*: As to claim 23**,[28] it is unclear whether Suga discloses that after a predetermined time has passed, the wafer is treated again with said energy wave. However, Yamauchi discloses that after predetermined time (in cleaning chamber), chips 2 and substrate 3 are conveyed and simultaneously treated again by energy wave immediately before bonding [¶ 147]. It would have been obvious to a person of ordinary skill in the art at the time of the invention to treat the bonding surfaces again with the energy wave in the method of Suga in order to provide sufficient activated surfaces to allow room-temperature bonding.[29]

But, Allegation 4 is erroneous and unsupported by any evidence provided by the Office Action. Therefore, the combination of **Suga** in view of **Yamauchi** cannot teach or suggest all of these claimed features of Claim 23 for this additional reason, and Claim 23 is patentable over this combination for this additional reason.

I. Response to Rejection of Claim 7 under 35 U.S.C. § 103(a) as Being Unpatentable over Suga et al., in View of Yamauchi in further View of Linn

At Section 5 of the Office Action, Claim 7 is rejected under 35 U.S.C. § 103(a) as being unpatentable over **Suga** in view of **Yamauchi**, and in further view of U.S. Patent No. 5,833,758 to Linn et al. (hereafter "**Linn**").[30] This rejection is respectfully traversed with respect to Claim 7 as currently presented.

Claim 7 depends from Claim 2 at least indirectly. Claim 2 is patentable over the combination of **Suga** in view of **Yamauchi** for the reasons discussed above in Section H. **Linn**

[27] See Office Action, p. 6.
[28] Emphasis in original.
[29] See Office Action, pp. 6-7.
[30] See Office Action, p. 7.

is only cited for allegedly describing an RF plasma generating power supply.[31] Accordingly, **Linn** cannot remedy the failure of the combination of **Suga** in view of **Yamauchi** to teach or suggest the claimed feature of **bonding objects in solid phase by crushing an adhering substance layer readhering to gold bonding portions by pressing the objects to be bonded**. Therefore, the combination of **Suga** in view of **Yamauchi** and **Linn** cannot teach or suggest all of these claimed features, and Claim 2 is patentable over **Suga** in view of **Yamauchi** and **Linn** for at least this reason.

Because Claim 7 depends from Claim 2, at least indirectly, this claim includes all of the patentable features of Claim 2. Therefore, Claim 7 is patentable over the combination of **Suga** in view of **Yamauchi** and **Linn** for at least the same reasons that Claim 2 is patentable over this combination.

J. Response to Rejection of Claims 9 and 10 under 35 U.S.C. § 103(a) as Being Unpatentable over Suga in View of Linn and Usui

At Section 6 of the Office Action, Claims 9 and10 are rejected under 35 U.S.C. § 103(a) as being unpatentable over **Suga** in view of **Linn** and U.S. Patent Application No. 2004/0140551 to Usui et al. (hereafter "**Usui**").[32] This rejection is respectfully traversed with respect to Claims 9 and 10 as currently presented.

Claims 9 and 10 depend from Claim 2, either directly or indirectly. Claim 2 is patentable over **Suga** for the reasons discussed above in Section F. **Linn** is only cited for allegedly describing an argon plasma cleaning the roughens the surface and enhancing the solderability to the substrate by increasing the surface bonding layer.[33] **Usui** is only cited for allegedly describing surface processing of a metal film to form a patterned interconnect line and to achieve a surface roughness of 1 micron or less which effectively improves the high frequency performance.[34] Accordingly, **Linn** and **Usui** cannot remedy the failure of **Suga** to teach or suggest the claimed feature of **bonding objects in solid phase by crushing an adhering**

[31] See Office Action, p. 7.
[32] See Office Action, pp. 7-8.
[33] See Office Action, pp. 7-8.
[34] See Office Action, p. 8.

substance layer readhering to gold bonding portions by pressing the objects to be bonded. Therefore, the combination of **Suga** in view of **Linn** and **Usui** cannot teach or suggest all of these claimed features, and Claim 2 is patentable over **Suga** in view of **Linn** and **Usui** for at least this reason.

Because Claims 9 and 10 depend from Claim 2, either directly or indirectly, these claims include all of the patentable features of Claim 2. Therefore, Claims 9 and 10 are patentable over the combination of **Suga** in view of **Linn** and **Usui** for at least the same reasons that Claim 2 is patentable over this combination.

In addition, with respect to Claim 9, this claim has been rejected based on the following allegation:

> ***Allegation 5*: As to claim 9**,[35] Suga fails to disclose the bonding portion having a surface roughness. However, **Linn**[36] discloses that argon plasma cleaning (similar to Suga) roughens the surface and enhances the solderability to the substrate by increasing the surface of the bonding layer [col. 3, lines 12-15]. It would have been obvious to a person of ordinary skill in the art at the time of the invention to provide RF plasma generation similar to Linn in the method of Suga in order remove all contaminants from the surface and consequently improve bonding (Linn- abstract). Linn is silent about surface roughness value. However, Usui et al. ("**Usui**"[37], drawn to manufacturing semiconductor device) discloses surface processing a metal film to form a patterned interconnect line and to achieve surface roughness of 1 micron or less (i.e. greater than 120 nm), which effectively improves the high frequency performance ¶[24; claim 14]. **The collective disclosures of Suga, Linn and Usui teaches a bonding portion having the surface roughness value 120 nm or more, and providing so would have been obvious to a person of ordinary skill in the art at the time of the invention in order to increase the surface area and improve bonding strength (Linn) and device performance (Usui)**.[38]

But, the underlined assertions in Allegation 5 is erroneous and unsupported by any evidence provided by the Office Action. Therefore, the combination of **Suga** in view of **Linn** and **Usui**

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[35] Emphasis in original.
[36] Emphasis in original.
[37] Emphasis in original.
[38] See Office Action, pp. 7-8 (emphasis added).

cannot teach or suggest all of these claimed features of Claim 9 for this additional reason, and Claim 9 is patentable over this combination for this additional reason.

In addition, with respect to Claim 9 as currently presented, the proposed combination of **Linn** with **Suga** teaches away from the claimed feature of an **adhering substance layer readhering to said bonding portions**. Allegation 5 asserts that a person of ordinary skill in the art would allegedly combine **Linn** with **Suga "in order remove all contaminants from the surface**."[39] Therefore, Claim 9 is patentable over the combination of **Suga** in view of **Linn** and **Usui** for this additional reason.

In addition, with respect to Claim 10, this claim has been rejected based on the following allegation:

> ***Allegation 6*: As to claim 10,**[40] Suga discloses the bonding method including:
> i. a head 16 [fig. 1] for holding one of the objects to be bonded;
> ii. a stage 15 for holding the other object to be bonded; and
> iii. a vertical drive mechanism for performing a position control with respect to at least one of said head and said stage in a direction substantially perpendicular to said bonding surface of said object to be bonded, and performing a pressing control [¶26],
> iv. **the vertical drive mechanism of Suga is implicitly stopped at some point, when the bumps 2a and pads 14a are being bonded, thus it holds a constant height of the head 16 from said stage for a predetermined time**.[41]

But, the underlined assertions in Allegation 6 is erroneous and unsupported by any evidence provided by the Office Action. Therefore, the combination of **Suga** in view of **Linn** and **Usui** cannot teach or suggest all of these claimed features of Claim 10 for this additional reason, and Claim 10 is patentable over this combination for this additional reason.

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[39] Emphasis added.
[40] Emphasis in original.
[41] See Office Action, p. 8 (emphasis added).

K. Response to Rejection of Claims 11, 12 and 20 under 35 U.S.C. § 103(a) as Being Unpatentable over Suga, in View of Yagi

At Section 7 of the Office Action, Claims 11, 12 and 20 are rejected under 35 U.S.C. § 103(a) as being unpatentable over **Suga**, in view of U.S. Patent No. 5,686,353 to Yagi et al. (hereafter "**Yagi**").[42] This rejection is respectfully traversed with respect to Claims 9 and 10 as currently presented.

Claims 11, 12 and 20 depend from Claim 2, either directly or indirectly. Claim 2 is patentable over **Suga** for the reasons discussed above in Section F. **Yagi** is only cited for allegedly describing: (1) a leveling step to obtain uniform height of each of the bumps, and adapting the height of each of the bumps to corresponding height of each of the electrodes on the substrate,[43] and (2) positioning the semiconductor device (i.e. chip) in relation to the substrate in a manner so as to transform the apex portion of each of the bumps and thus adapt height of each of the bumps to each of corresponding electrodes[44]. Accordingly, **Yagi** cannot remedy the failure of **Suga** to teach or suggest the claimed feature of **bonding objects in solid phase by crushing an adhering substance layer readhering to gold bonding portions by pressing the objects to be bonded**. Therefore, the combination of **Suga** in view of **Yagi** cannot teach or suggest all of these claimed features, and Claim 2 is patentable over **Suga** in view of **Yagi** for at least this reason.

Because Claims 11, 12 and 20 depend from Claim 2, either directly or indirectly, these claims include all of the patentable features of Claim 2. Therefore, Claims 11, 12 and 20 are patentable over the combination of **Suga** in view of **Yagi** for at least the same reasons that Claim 2 is patentable over this combination.

In addition, with respect to Claim 20, this claim has been rejected based on the following allegation:

> ***Allegation 7*: As to claim 20,**[45] Suga discloses electrically functioning device that

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[42] See Office Action, pp. 9-10.
[43] See Office Action, p. 9.
[44] See Office Action, p. 9.
[45] Emphasis in original.

> employs the bonding portion as an electrode, bonding portion formed of gold, and cleaned with energy wave before bonding in air. However, it is unclear whether Suga discloses adjusting optimum positions of the objects to be bonded while the device is caused to electrically function. **Yagi**[46] discloses positioning the semiconductor device (i.e. chip) in relation to the substrate in a manner so as to transform the apex portion of each of the bumps and thus adapt height of each of the bumps to each of corresponding electrodes [col. 6, lines 4-12]. Yagi further states that such provides extreme stability and accuracy, even if the electrodes have irregularity of thickness, or if the substrate has a warp. Yagi also discloses that the function test the electrical circuit is performed when the device is pressed against the substrate [col. 6, lines 22-28]. **It would have been obvious to a person of ordinary skill in the art at the time of the invention to perform positioning step of Yagi in the method of Suga because it provides extreme stability and accuracy**, even if the electrodes have irregularity of thickness, or if the substrate has a warp or undulation [col. 6, lines 13-21].[47]

But, the underlined assertions in Allegation 7 is erroneous and unsupported by any evidence provided by the Office Action. Therefore, the combination of **Suga** in view of **Yagi** cannot teach or suggest all of these claimed features of Claim 20 for this additional reason, and Claim 20 is patentable over this combination for this additional reason.

L. Response to Rejection of Claim 16 under 35 U.S.C. § 103(a) as Being Unpatentable over Suga, in View of Usui

At Section 8 of the Office Action, Claim 16 is rejected under 35 U.S.C. § 103(a) as being unpatentable over **Suga**, in view of **Usui**.[48] This rejection is respectfully traversed with respect to Claim 16 as currently presented.

Claim 16 ultimately depends from Claim 2. Claim 2 is patentable over **Suga** for the reasons discussed above in Section F. **Usui** is only cited for allegedly describing semiconductor device mounting) discloses a gold film 402 having a thickness of about 1-10 micron on a copper base material which has a hardness of 200 Hv or less.[49] Accordingly, **Usui** cannot remedy the failure of **Suga** to teach or suggest the claimed feature of **bonding objects in solid phase by**

[46] Emphasis in original.
[47] See Office Action, pp. 9-10 (emphasis added).
[48] See Office Action, p. 10.
[49] See Office Action, p. 10.

crushing an adhering substance layer readhering to gold bonding portions by pressing the objects to be bonded. Therefore, the combination of **Suga** in view of **Usui** cannot teach or suggest all of these claimed features, and Claim 2 is patentable over **Suga** in view of **Usui** for at least this reason.

Because Claim 16 ultimately depends from Claim 2, these claims include all of the patentable features of Claim 2. Therefore, Claim 16 is patentable over the combination of **Suga** in view of **Usui** for at least the same reasons that Claim 2 is patentable over this combination.

M. Response to Rejection of Claim 50 under 35 U.S.C. § 103(a) as Being Unpatentable over Yamauchi in view of Applicant Admitted Prior Art

At Section 9 of the Office Action, Claim 50 is rejected under 35 U.S.C. § 103(a) as being unpatentable over of **Yamauchi** in view of applicant admitted to prior art AAPA - JP 2791429 (hereafter "**AAPA**").[50] This rejection is respectfully traversed with respect to Claim 50 as currently presented.

As currently amended, Claim 50 includes the features of "contacting said bonding portions of said objects to be bonded with each other in a low vacuum of 10^{-5} Torr or more in the atmospheric air; and **crushing an adhering substance layer readhering to said bonding portions by pressing said objects to be bonded**, thereby bonding objects to be bonded together, **said adhering substance layer is formed of oxide film or organic substances**, wherein said bonding portions of objects to be bonded have a hardness of 20 Hv to 200 Hv, and bonding objects to be bonded is performed in a **solid phase** at low temperatures between room temperature and 180°C." In contrast, **Yamauchi** teaches that the objects to be bonded are bonded while **cleaning** the surfaces of the **bonding portion** (metal connection parts) with flowing energy wave **so as to prevent impurities from readhering to the bonding portion**.[51] **Yamauchi** even specifically states, "Since the bonding [in **Yamauchi's** process is] carried out immediately after oxide films and organic substances on the surfaces are removed by the energy wave or energy particles and reformation of the oxide films and organic substances can be

[50] See Office Action, pp. 10-11.
[51] See, for example, **Yamauchi**, paragraphs [0001], [0008], [0009], [0010]

maintained to be prevented, bonding at an atmospheric pressure, particularly, bonding substantially in air with an atmospheric pressure, becomes possible."[52] Therefore, **Yamauchi** **explicitly teaches away from the claimed feature that the bonding portions have a readhering substance layer formed of oxide film or organic substances**.

AAPA teaches bonding objects under the conditions that **prevent an adhering substance layer from readhering to the bonding portion which has been previously surface-activated**. More specifically, according to **AAPA**, the bonding is performed in high vacuum so as to **prevent impurities from readhering to the bonding portion after the surface activation of the bonding portion**. In addition, the degree of vacuum in AAPA indicates that during processing by inert gas such as Ar gas or the like, and impurities such as oxygen, organic substances or the like are not included in an atmosphere wherein the bonding process is performed. As a result, it is possible to perform the bonding even in the degree of vacuum of about 10^{-5} Torr. On the contrary, according to the claimed invention, the bonding is performed in a low vacuum region in the atmospheric air. Therefore, impurities such as oxygen, organic substances or the like are included in the atmosphere even though the degree of vacuum is 10^{-5} Torr. That is, the degree of vacuum in the present invention is basically different from the degree of vacuum taught by AAPA in terms of the contents of the atmosphere. For all of the above reasons, **AAPA** **explicitly teaches away from the claimed feature that the bonding portions have a layer formed of oxide film or organic substances**.

For at least the above reasons, the combination of **Yamauchi** in view of **AAPA** not only does not teach or suggest all of the features of Claim 50, but actually teach away from the claimed invention. Therefore, Claim 50 is patentable over **Yamauchi** in view of **AAPA** for at least this reason.

Also, according to the present invention, after completely removing the impurities from the bonding surface by Ar bombardment, the bonding surface contacts with the impurities again in the atmosphere of 10^{-5} Torr or more. If heated in this condition, the bonding surface and the impurities are strongly atomically bonded. However, according to the present invention, the impurities are just absorbed onto the bonding surface, not strongly atomically bonded.

[52] See **Yamauchi**, paragraph [0012].

Accordingly, since the impurities are easily moved by application of pressure or the like, the impurities are removed from the bonding surface. As a result, the bonding surfaces are bonded.

According to Claim 50, the adhering substance layer, such as oxide film or the like, atomically adhering to the bonding portion is completely removed with an energy wave, such as a plasma or the like. Then, the bonding is performed in a solid phase at low temperature between room temperature and 180°C in a low vacuum of 10^{-5} Torr or more in the atmospheric air which is assumed that impurities. such as dirt, dust. water molecules, organic substances or the like, are included.

That is, the bonding portions are contacted with each other under the environment in which the adhering substance layer readheres to the bonding portion. Even if the impurities, such as organic substances or the like, readhere to the bonding portion, the impurities are just absorbed onto the bonding portion. Therefore, the reabsorbed substance layer readhering to the bonding portion is pushed and moved by pressing the objects to be bonded by each other, and the objects to be bonded are bonded. In this case, an interface of the bonding portion is deformed by making the bonding portion have a hardness of 200 Hv or less, so that the reabsorbed substance layer reabsorbed onto the bonding portion is pushed and moved to form a new surface on the bonding portion. As a result, the bonding portions are bonded as shown in FIG. 1 of the present application.[53]

In contrast, in **Yamauchi** and **AAPA**, bonding is performed while keeping the exposed condition of the dangling bonds of the atoms under the condition of preventing the adhering substance layer from readhering to the bonding portion. More specifically, atoms of impurities (oxides) bonded to atoms of a bonding surface are forcibly removed by Ar bombardment to expose dangling bonds of the atoms of the bonding surface. **In an atmosphere wherein the exposed dangling bonds do not contact with atoms of other impurities, the bonding with dangling bonds of the other bonding portion is performed.** More specifically, according to AAPA, **the bonding is performed in high vacuum** so as to prevent impurities from readhering to the bonding portion after the surface activation of the bonding portion. Therefore, after performing Ar etching, the objects to be bonded are bonded **in the super-high vacuum wherein any other atoms do not exist to keep the exposed condition of the dangling bonds**.

[53] See

According to Yamauchi, the objects to be bonded are bonded **while cleaning the bonding portion with a flowing energy wave so as to impurities from readhering to the bonding portion**.

Based on **Yamauchi** and **AAPA** in which the bonding is performed while keeping the exposed condition of the dangling bonds of the atoms under the condition of preventing the adhering substance layer from readhering to the bonding portion, it is not possible to come up with the present invention assuming the condition in which the reabsorbed substance layer is reabsorbed onto the bonding portion which has been completely surface-activated. Accordingly, bonding principle of the invention described in Claim 50 is a newly established bonding principle that has been discovered as the result of various experiments by the inventors. Therefore, Claim 50 is patentable over **Yamauchi** in view of **AAPA** for at least this additional reason.

In addition, the Office Action has failed to properly explain why a person of ordinary skill in the art would combine **AAPA** with **Yamauchi.** As stated in the MPEP at § 707.07(f), "obviousness [under § 103] can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is **some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art**.[54] But the Office Action has failed to provide a proper teaching, suggestion or motivation for combining **AAPA** with **Yamauchi.**

In an attempt to provide a reason for combining **AAPA** with **Yamauchi** the Office Action relies upon the following allegation:

> ***Allegation 8*:** Yamauchi discloses bonding in a vacuum condition [¶ 28] but does not disclose low vacuum of 10^{-5} torr or more. However, **AAPA**[55] discloses that it is known to perform surface activating treatment and subsequent bonding in a high vacuum of 10^{-5} torr or more [¶ 13 of publication]. **It would have been obvious to a person of ordinary skill in the art at the time of the invention to carry out bonding at claimed vacuum range in the method of Yamauchi since such is well-known in the art. Moreover, it would have been obvious to one of ordinary skill in the art at the time of the invention to choose the instantly claimed ranges through process optimization, since it has been held that**

[54] See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992) (emphasis added).
[55] Emphasis in original.

> **where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. Thus, in the method of Yamauchi and AAPA, under vacuum of about 10^{-5} torr, adhering substance layer would intrinsically form on the bonding surfaces, and consequently crushed at the time of bonding**.[56]

But Allegation 8 ignores the fact that **Yamauchi** and **AAPA** describe two entirely different types of bonding techniques. The underlined portion of Allegation 3 is also erroneous and unsupported by any evidence provided by the Office Action.

Yamauchi describes a bonding technique that employs metal to metal bonding. In contrast, **AAPA** only describes a bonding technique between Si and Si, and never describes a bonding technique between metal and metal as described in **Yamauchi**, or in the claimed invention.. Therefore, contrary to what is asserted in Allegation 3, it is apparent that even one skilled in the art cannot easily apply vacuum state or the like in the bonding technique between materials of glass system composed of Si to the bonding metal-metal bonding technique such as described in **Yamauchi**. Accordingly, Office Action fails to provide a proper teaching, suggestion or motivation for combining **AAPA** with **Yamauchi**, and the rejection of Claim 50 under 35 U.S.C. § 103(a) as being unpatentable over of **Yamauchi** in view **AAPA** is *prima facie* improper for at least this reason.

For at least the reasons discussed above, Claim 50 is patentable over **Yamauchi** in view of **AAPA.**

N. Response to Rejection of Claim 50 under 35 U.S.C. § 103(a) as Being Unpatentable over Suga in view of Applicant Admitted Prior Art

At Section 10 of the Office Action, Claim 50 is rejected under 35 U.S.C. § 103(a) as being unpatentable over **Suga** in view of **AAPA**.[57] This rejection is respectfully traversed with respect to Claims 3, 4 and 14 as currently presented.

As currently presented, Claim 50 includes the features of: "contacting said bonding portions of said objects to be bonded with each other in a low vacuum of 10^{-5} Torr or more in the atmospheric air; and **crushing an adhering substance layer readhering to said bonding**

[56] See Office Action, pp. 11-12 (emphasis added).
[57] See Office Action, pp. 12-13.

portions by pressing said objects to be bonded, thereby bonding objects to be bonded together, said adhering substance layer is formed of oxide film or organic substances, wherein said bonding portions of objects to be bonded have a hardness of 20 Hv to 200 Hv, and bonding objects to be bonded is performed in a **solid phase** at low temperatures between room temperature and 180°C." In contrast, **Suga** specifically describes, "**thermally bonding** a **cleaned metal** joint part of the first object to a portion to be bonded of the second object by **heating** in special gas atmosphere."[58] Accordingly, **Suga** explicitly **teaches away from the claimed feature** of **bonding objects in solid phase by crushing an adhering substance layer readhering to gold bonding portions by pressing the objects to be bonded**. Therefore, **Suga** cannot teach or suggest all of the features of Claim 50 as required under 35 U.S.C. § 103.[59]

According to Claim 50, the adhering substance layer, such as oxide film or the like, atomically adhering to the bonding portion is completely removed with an energy wave, such all a plasma or the like. Then, the bonding is performed in a solid phase at low temperature between room temperature and 180°C in a low vacuum of 10^{-5} Torr or more in the atmospheric air which is assumed that impurities. such as dirt, dust. water molecules, organic substances or the like, are included.

That is, the bonding portions are contacted with each other under the environment in which the adhering substance layer adheres to the bonding portion. Even if the impurities, such as organic substances or the like, readhere to the bonding portion. the impurities are just absorbed onto the bonding portion. Therefore, the reabsorbed substance layer readhering to the bonding portion is pushed and moved by pressing the objects to be bonded by each other, and the objects to be bonded are bonded. In this case, an interface of the bonding portion is deformed during pressing the objects to be bonded by each other by making the bonding portion have a hardness of 20 Hv to 200 Hv, so that the reabsorbed substance layer reabsorbed onto the bonding portion is pushed and moved to form a new surface on the bonding portion. As a result, the bonding portions are bonded in a solid phase (see, for example, Fig. 1 of the present application).

In **Suga's** process, because incomplete surface activation of the bonding portion is performed, there remain adhering substance layer atomically bonding to the surface of the

[58] See **Suga**, paragraph [0009].
[59] 35 U.S.C. § 103 requires that "All words in a claim must be considered in judging the patentability of that claim against the prior art", see MPEP § 2143.03, citing *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

bonding portion. The adhering substance layer which atomically adheres cannot be crushed only by pressing, so that a new surface is not formed on the bonding portion, as in the claimed invention. Therefore, the heat diffusion bonding by heating the objects to be bonded is performed in **Suga**. Accordingly, based on **Suga**, there is no suggestion of the claimed invention wherein the readhering substance layer which readheres by being absorbed onto the surface of the bonding portion is crushed by pressing the objects to be bonded by each other.

In general **Suga** relates to a bonding method that employs heating, **melting** and diffusing a metal. Although the specification of **Suga** describes a gold/gold bonding, etc. as an example of the bonding between metal and metal, all of these bonding techniques require heating, **melting** and diffusing metal. Therefore, the bonding technique of **Suga**. is clearly different from the bonding technique of the claimed invention which bonds using gold in a **solid phase** at low temperature between room temperature and 180°C. According to **Suga**, since incomplete surface activation of the bonding portion is performed, an adhering substance layer remains atomically bonding to the surface of the bonding portion. But, in **Suga**, the adhering layer which atomically adheres cannot not be crushed only by pressing, so that a new surface is not formed on the bonding portion. Therefore, the heat diffusion bonding of **Suga** requires heating the objects to be bonded so that are melted to thereby allowing the combining of the bonding portions. Therefore, based on **Suga**, cannot teach or suggest the claimed invention wherein a readhering substance layer which readheres by being absorbed onto the surface of the bonding portion is crushed by pressing the objects to be bonded by each other, thereby bonding the objects to be bonded together in a solid phase,

According to **Suga**, secondary oxidation of solder bumps during bonding the objects to be bonded by heating at high temperature is prevented in inert gas by blowing out a special gas free from impurities toward the solder bumps after oxide film (primarily oxidation) generated when forming the solder bumps is removed by Ar bombardment. Regarding the readhering substance layer which readheres by being absorbed onto the surface of the bonding portion after complete surface activation thereof, it is highly probable to atomically bond to the bonding portion due to secondary oxidation by heating in the atmosphere if not blowing out the special gas as disclosed in **Suga**. Therefore, the objects to be bonded are contacted with each other at low temperature between room temperature and 180°C, in the present invention. According to the present invention, after completely removing the impurities from the bonding surface by Ar

bombardment, the bonding surface contacts with the impurities again in a low vacuum of 10^{-5} Torr or more in the atmospheric air. If heated at high temperature in this condition, the bonding surface and the impurities are strongly atomically bonded. However, according to the present invention, because of low temperature between room temperature and 180°C, the impurities are just absorbed onto the bonding surface, not strongly atomically bonded by heat diffusion bonding by heating the object to be bonded to melt and combine. Accordingly, since the impurities are easily moved by application of pressure or the like, the impurities are removed from the bonding surface. As a result, the bonding surfaces are bonded. The bonding technique taught or suggested by **Suga** is quite different from the present invention. Accordingly, it is not possible to come up with the present invention no matter how the invention described in **Suga** is combined with the technique suggested by **Suga**.

In an attempt to provide a reason for combining **AAPA** with **Suga** the Office Action relies upon the following allegation:

> ***Allegation 9:*** Suga discloses bonding in a vacuum condition [¶11] but does not disclose low vacuum of 10^{-5} torr or more. However, **AAPA**[60] discloses that it is known to perform surface activating treatment and subsequent bonding in a high vacuum of 10-5 torr or more [¶13 of publication]. It would have been obvious to a person of ordinary skill in the art at the time of the invention to carry out bonding at claimed vacuum range in the method of Suga since such is well-known in the art. **Moreover, it would have been obvious to one of ordinary skill in the art at the time of the invention to choose the instantly claimed ranges through process optimization, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. Thus, in the method of Suga and AAPA, under vacuum of about 10^{-5} torr, adhering substance layer would intrinsically form on the bonding surfaces, and consequently crushed at the time of bonding**.[61]

But, the underlined assertions in Allegation 9 is erroneous and unsupported by any evidence provided by the Office Action. Furthermore, for at least the reason discussed above, it not possible to produce the proposed combination of **AAPA** with **Suga.**

For at least the above reasons, Claim 50 is patentable over **Suga**.

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[60] Emphasis in original.
[61] See Office Action, p. 13 (emphasis added).

O. Claims 2-20, 22-25 and 50 have been Rejected Based on Facts within the Personal Knowledge of the Examiner

As discussed above in Sections F, H, J, K, M and N, Allegations 1, 2, 3, 4, 5, 6, 7, 8 and 9are unsupported by any evidence provided by the Examiner. Accordingly, the Applicants can only conclude that the Examiner is aware of facts that support these allegations but have not yet been provided to the Applicants by the Examiner. Furthermore, because the rejections of Claims 2-20, 22-25 and 50 rely upon these allegations, these claims have been rejected on the basis of facts within the personal knowledge of the Examiner.

Therefore, Applicants hereby request that the Examiner either: (1) provide an Affidavit under 37 C.F.R. § 104(d)(2)[62] that contains facts supporting the Examiner's unsupported allegations, or: (2) withdraw the rejections of Claims 2-20, 22-25 and 50 that rely upon these rejections.

[62] See 37 C.F.R. § 1.104(d)(2) which states: "When a rejection in an application is based on facts within the personal knowledge of an employee of the Office, the data shall be as specific as possible, and the reference must be supported, when called for by the applicant, by the affidavit of such employee, and such affidavit shall be subject to contradiction or explanation by the affidavits of the applicant and other persons." Applicants note that in the unpublished case of *In re Sun*, 31 USPQ2d 1451, 1455 (Fed. Cir. 1993), the USPTO argued "the procedures established by 37 C.F.R. Section 1.107(b) (1993) [now 37 C.F.R. § 1.104(d)(2)] ***expressly entitle*** an Applicant, on mere request, to an examiner affidavit that provides [citations that support the Examiner's asserted level of skill in the art]" (emphasis added). Furthermore, in *In re Sun*, the Federal Circuit, held that "this procedure, so readily available, helps save the lack of citation in an office action from possible constitutional infirmity in denying reasonable notice and hence due process." See 31 USPQ2d at 1455.

CONCLUSION

In view of the foregoing amendments and remarks, Applicant respectfully requests reconsideration of this Application and the prompt allowance of all pending claims currently under consideration. Applicants also respectfully request that upon allowance of the claims currently under consideration, all currently pending claims that have been withdrawn and which depend from an allowed claim be reinstated and allowed.

Should the Examiner feel that there are any issues outstanding after consideration of this response, the Examiner is invited to contact Ajay A. Jagtiani at (202) 312-3380 to expedite prosecution of the application.

The Commissioner is hereby authorized by this paper to charge any fees during the entire pendency of this application including fees due under 37 C.F.R. §§ 1.16 and 1.17 which may be required, including any required extension of time fees, or credit any overpayment to **Deposit Account 22-0259**.

Respectfully submitted,

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